

# TROUT OF CALIFORNIA



## **NOTE TO READERS**

This electronic document is a scanned version of the printed booklet that was very popular and offered free to the public for as long as it was in print. Funds have not been available for several years either for reprinting, or for revision. Nevertheless, the booklet contains information on trout occurring in California that is as valid today as when originally written. Do keep in mind, however, that the document is old, so serious researchers are advised to consult libraries or Department of Fish and Game staff for up-to-date information on the species described, including current scientific names for these animals. Anglers should consult current fishing regulations for seasons, size and bag limits, or any other requirements for take of these animals.

## **STATE OF CALIFORNIA**

RONALD REAGAN, *Governor*

### **THE RESOURCES AGENCY**

N. B. LIVERMORE, JR., *Secretary for Resources*

### **FISH AND GAME COMMISSION**

JAMES Y. CAMP, *President*, Shafter

C. RANS PEARMAN, *Vice President*  
San Gabriel

SHERMAN CHICKERING, *Member*  
San Francisco

JOSEPH RUSS, III, *Member*  
Ferndale

PETER T. FLETCHER, *Member*  
Rancho Santa Fe

### **DEPARTMENT OF FISH AND GAME**

G. RAY ARNETT, *Director*

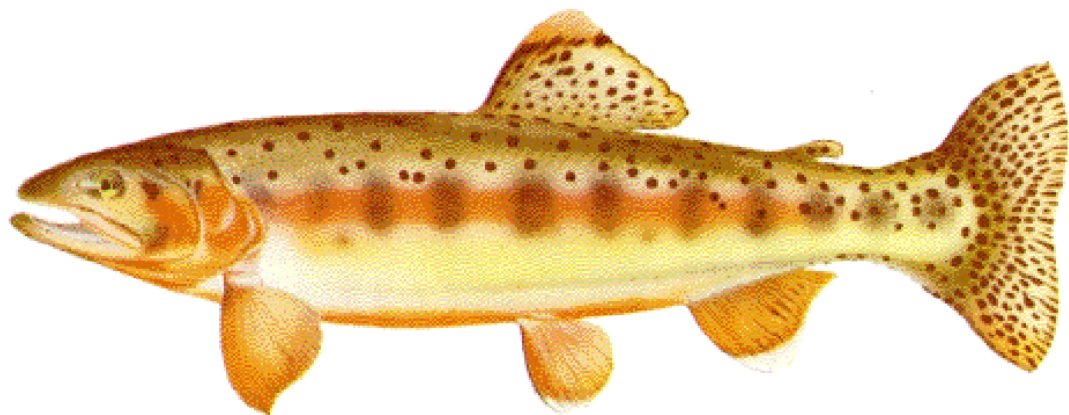
1416 Ninth Street  
Sacramento, California 95814

# TROUT

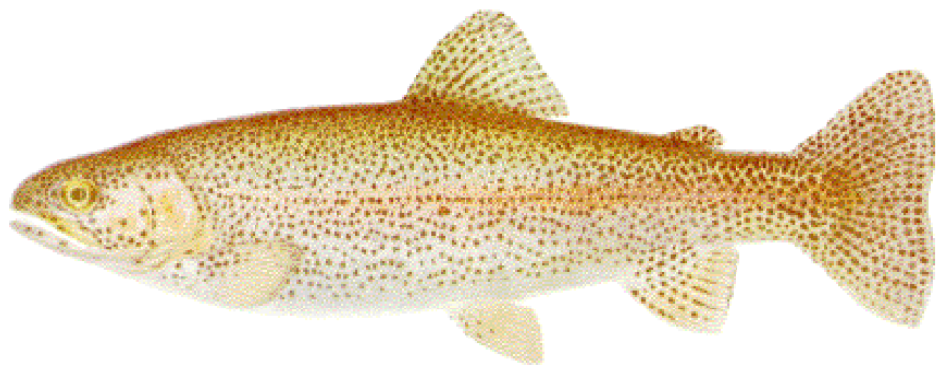
## *of California*



First Printing 1957  
Second Printing 1962  
Third Printing (Revised) 1964  
Fourth Printing 1966  
Fifth Printing 1968  
Sixth Printing (Revised) 1969



GOLDEN TROUT  
*Salmo gairdneri*



RAINBOW TROUT  
*Salmo gairdneri*

—From a painting by Charles Bradford Hudson, 1910

## FOREWORD

At one time or another, nearly every angler has wondered about the spawning habits of trout, about the development of their eggs, what the young fish eat, how long trout live, and how large they may eventually grow.

The differences between a rainbow and a steelhead, and between a brown and a Loch Leven, have provided many a campfire conversation topic. Invariably, talk turns to such matters as the senses of trout, how they breathe, how fast they can swim, the best way to determine their age, why some trout have pink meat, and how many planted hatchery trout are caught by anglers.

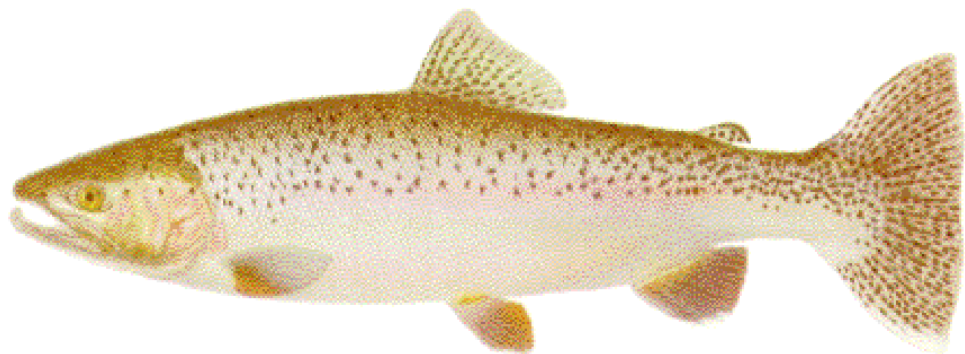
Since the average fisherman does not have a ready source of such information, this booklet has been designed to help fulfill this need. It is written for those people who have little knowledge of fish or fishing, as well as for those who have been fishing all their lives.

In brief, this booklet tells the story of California trout, their habits, life histories, and their distribution throughout the State.

## TABLE OF CONTENTS

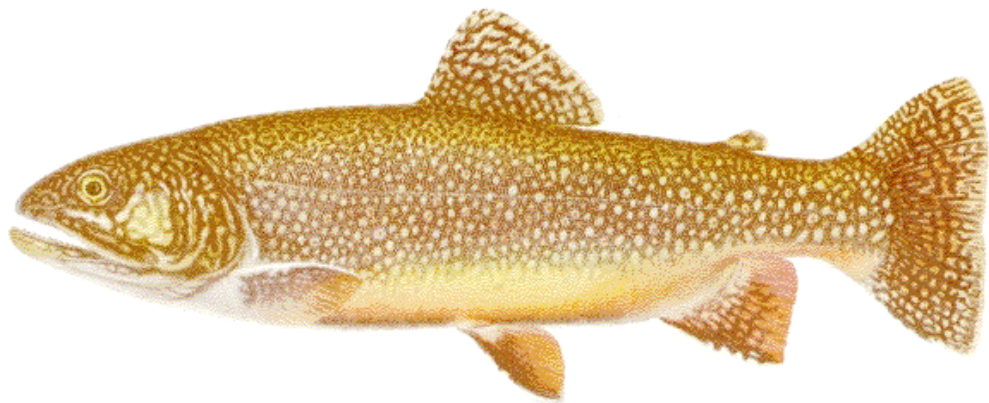
	Page
Foreword .....	4
What Is a Trout? .....	9
The Kinds of Trout in California .....	11
Rainbow Trout .....	13
Steelhead Rainbow Trout .....	15
Eagle Lake Rainbow Trout .....	17
Kamloops Rainbow Trout .....	19
Golden Trout .....	21
Coast Cutthroat Trout .....	23
Lahontan Cutthroat Trout .....	24
Piute Cutthroat Trout .....	25
Brown Trout .....	26
Dolly Varden Trout .....	28
Eastern Brook Trout .....	29
Lake Trout or Mackinaw .....	31
Kokanee Salmon .....	32
Mountain Whitefish .....	33
Trout Hybrids .....	34
Life Story of the Trout .....	35
Insects in the Diet of Trout .....	38
Some Record Trout Caught with Rod and Reel .....	42
Oldest Known Trout .....	42
Trout Senses .....	42
Other Interesting Facts .....	44
Trout Management .....	47
Common Questions .....	52
Suggested Reading .....	54
Acknowledgments .....	55
Glossary .....	56





STEELHEAD RAINBOW TROUT  
*Salmo gairdnerii gairdnerii*

—from a painting by Charles Bradford Hudson, 1910

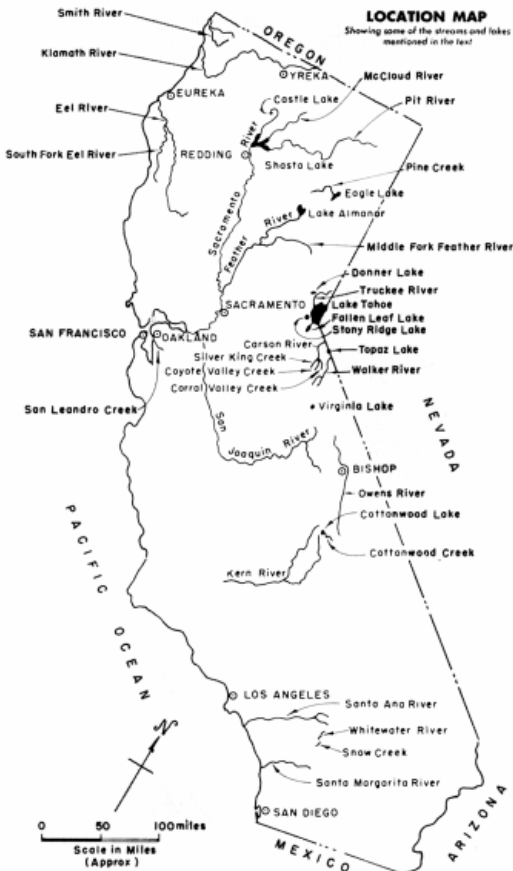


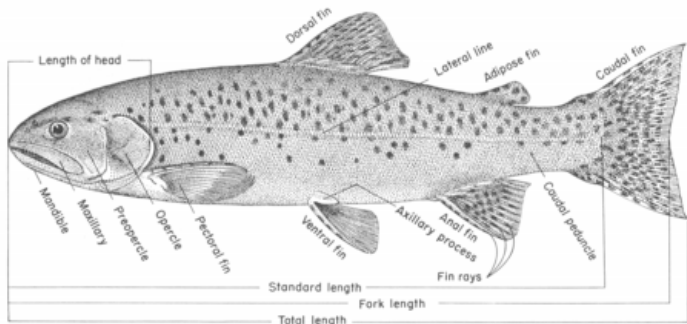
EASTERN BROOK TROUT  
*Salvelinus fontinalis*

—From a painting by Charles Bradford Hudson, 1910

## LOCATION MAP

Showing some of the streams and lakes mentioned in the text





***General trout structure***

## **WHAT IS A TROUT?**

Trout are members of the great family of fishes known as Salmonidae, which includes the salmon. They are typically inhabitants of the colder streams and lakes of North America, Europe, and Asia. Under suitable conditions, many kinds migrate to sea, but all spawn in fresh water.

There is nothing so very unusual about the appearance of a trout, except perhaps the adipose fin (see illustration) which grows from the back about half way between the dorsal fin and the tail, or caudal, fin. All members of the family Salmonidae have this adipose fin.

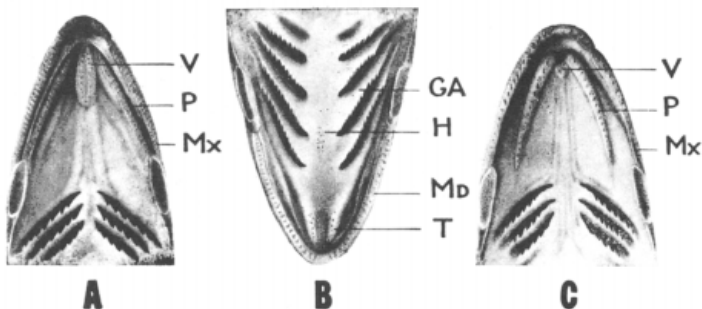
All trout have bodies shaped a good deal like the illustration above. The mouth is never located on the underside of the head as in the suckers and carp. It is always at the tip of the head and it is quite large, the maxillary bone projecting back to the eye or behind it. It is never small, as in the whitefish. Trout have the usual number of fins, but their location on the body is not quite the same as in many other fishes.

From the illustration it can be seen that the pectoral fins, one on each side just behind the head, are set low, almost down to the belly. The pair of ventral fins is located about half way between the tip of the head and the tip of the tail. In a bass these fins are much farther forward.

All trout have scales after they have grown to be a couple of inches long; even the brook trout has scales, though they are so small they are difficult to see.

If one becomes familiar with the illustrations of trout in this booklet there is little danger of confusing a trout with fish of other families. But it is sometimes very difficult to distinguish trout from salmon or from whitefish.

In most of the lakes and streams of California there are no whitefish, which are relatives of trout. They are found only on the eastern slope of the Sierra Nevada in the Truckee, Carson, and Walker river drainages. The



Jaws and teeth of trout and char. Figure A shows the upper jaw and roof of mouth of Cutthroat trout. B shows the lower jaw, tongue, and lower half of gill arches of cutthroat trout. C reveals upper jaw and roof of mouth of Dolly Varden. Key to symbols: V—Vomer with teeth; P—palatine bone with teeth; Mx—maxillary; Md—mandible; GA—gill arch; H—Hyoid teeth on base of tongue; T—teeth on tip of tongue. Illustration courtesy of British Columbia Provincial Museum from Handbook No. 5, The Fresh-water Fishes of British Columbia.

whitefish has a small mouth, the maxillary bone extending back barely to the eye.

Salmon are often confused with steelhead and in the water it is difficult to tell them apart. Only after they have been caught and compared side-by-side can the layman see how they differ. In many coastal streams fishermen catch young silver salmon and call them trout. Actually yearling silver salmon up to five inches look so much like steelhead that it is no wonder they are often confused with them.

In these small fish one should count the rays of the anal fin; the salmon has more than 12, whereas the trout has 12 or fewer, as shown in the illustration.

After these small trout and salmon have migrated to the ocean and returned to the stream as mature fish ready to spawn, they are still a little difficult to distinguish. A quick way to tell them apart is to grasp the fish around the base of the tail (caudal peduncle)—if it slips through your hand, it is a steelhead and if it can be held quite easily, it is a salmon. The tail of a salmon is more rigid and more strongly forked, while that of the steelhead is softer and more nearly square. The inside of the mouth of a steelhead is white, while the inside of the mouth of a salmon is gray or blackish.

Looking at the scientific names of the trout described in this booklet, it will be noted that all belong to the genus *Salmo* except the eastern brook trout, Dolly Varden, and lake trout, or mackinaw. These three belong to the genus *Salvelinus* and are often called char. The differences between trout and char are small and not always easy to see. The char has teeth on the head, but not on the shaft of the vomer bone, which forms the roof

of the mouth. The trout has teeth on both the head and the shaft of the vomer (see illustration). Externally, the char has yellow or red spots, but no black spots, whereas the trout boasts a variety of colored spots, including black. In California today the term char is rarely used.

## THE KINDS OF TROUT IN CALIFORNIA

Seven species of trout are now present in California. In the list below, the official common names are shown at the left, while the corresponding scientific names at the right identify genus and species, in that order.

Brown trout	<i>Salmo trutta</i>
Cutthroat trout	<i>Salmo clarkii</i>
Rainbow trout	<i>Salmo gairdnerii</i>
Golden trout	<i>Salmo aguabonita</i>
Eastern brook trout	<i>Salvelinus fontinalis</i>
Dolly Varden trout	<i>Salvelinus mairna</i>
Lake trout	<i>Salvelinus namaycush</i>

Of these seven, the cutthroat, rainbow, golden, and Dolly Varden are natives, while the brown, eastern brook, and lake have been introduced into the State.

The cutthroat, rainbow, and golden are generally considered to consist of two or more subspecies, although ichthyologists who specialize in the classification of trout are not in full agreement with respect to the validity of some of them. Those presently officially recognized in California are the following.

Coast cutthroat trout	<i>Salmo clarkii clarkii</i>
Lahontan cutthroat trout	<i>Salmo clarkii henshawi</i>
Piute cutthroat trout	<i>Salmo clarkii seleniris</i>
Steelhead rainbow trout	<i>Salmo gairdnerii gairdnerii</i>
Kamloops rainbow trout	<i>Salmo gairdnerii kamloops</i>
Shasta rainbow trout	<i>Salmo gairdnerii stonei</i>
Kern River rainbow trout	<i>Salmo gairdnerii gilberti</i>
Eagle Lake rainbow trout	<i>Salmo gairdnerii aquilarum</i>
Royal silver rainbow trout	<i>Salmo gairdnerii regalis</i>
South Fork of Kern golden trout	<i>Salmo aguabonita aguabonita</i>
Little Kern golden trout	<i>Salmo aguabonita whitei</i>

In this booklet, we have included individual descriptions of most, but not all, of the subspecies. We have presented generalized descriptions of the rainbow and golden, because of their variability, especially with respect to general coloration and spotting, which vary greatly with type of a trout. We have also included individual descriptions of the steelhead, Kamloops, and Eagle Lake rainbows, because of their distinctiveness and the great interest of anglers in them. We have not included individual descriptions of the Shasta rainbow, because of questions regarding the validity of the subspecific name (the original description may have been based on sea-run specimens of the steelhead rainbow) and the purity of existing stocks; of the Kern River rainbow, because of its restricted distribution (the upper Kern River); or of the royal silver rainbow, because of its limited distribution (Lake Tahoe) and rarity (last reported in 1949).



*Brown trout abound in beautiful Convict Lake, Mono County, one of the most picturesque fishing lakes in California.—Photo by Phil Pister.*

## **RAINBOW TROUT**

*Salmo gairdnerii*



### **DISTINGUISHING CHARACTERISTICS**

The black spots vary in size from pin points up to about one-eighth inch in diameter, but are rarely large or perfectly round. They are usually found on the upper half of the head, on the upper half of the body, and on the dorsal and caudal fins.

The lateral band is usually conspicuous, reddish to violet, extending from the head to the caudal fin. The lower side of the head is commonly reddish.

There are no "cutthroat" dashes of red on the membrane beneath the jaw in typical rainbow, although some rainbow in some areas may show small orange marks similar to those of a cutthroat.

There are no small red spots on the sides, nor wavy marks or bars on the back or dorsal fin.

All trout vary somewhat in their coloration, but the rainbow are extremely variable. Rainbow in some lakes and reservoirs may be quite silvery except on the back; they may have very few spots and these may be indistinct, and the red on the head and sides may be completely lacking.

The rainbow trout illustrated above could be a yearling or a two year old fish and represents an average sized trout of this species. In older, larger rainbows the body proportions may be somewhat different, particularly in the older males, in which the lower jaw is much more prominent.

### **DISTRIBUTION IN CALIFORNIA**

The rainbow trout is widely scattered over California. It originally occurred in a large part of the trout streams of the State and in a few lakes. Since this is the fish most commonly raised in the trout hatcheries of California, it has been planted in nearly every lake and stream which is suitable



for trout. Therefore, it is by far the most widely distributed trout in California.

In many coastal streams this species is represented by the migratory steelhead in the lower portions and by resident fish in the headwaters. In some streams the ranges of the two overlap. Rainbows of one subspecies will hybridize with other subspecies and with cutthroat trout when their ranges are not separated by some barrier.

### INTERESTING FACTS

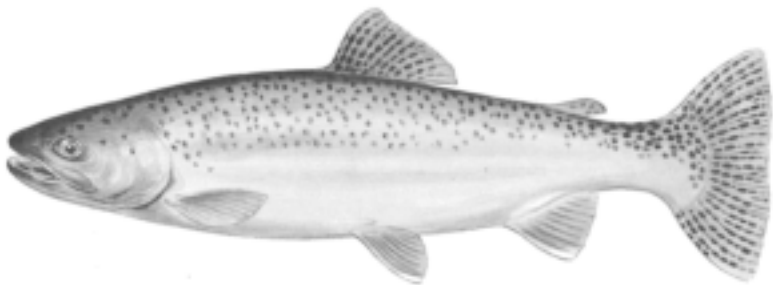
Resident rainbow rarely attain a large size in California. Steelhead rainbow grow much larger because they migrate to the ocean and spend one or more years under conditions much more favorable to rapid growth than are found in fresh water. However, in a few of the larger reservoirs and lakes in California rainbow do grow rapidly and one weighing 18 pounds was recorded from Lake Almanor.



*The Sacramento River near Castella, Shasta County, showing Mt. Shasta in the distance. This is one of the best rainbow trout streams in California.*

# STEELHEAD RAINBOW TROUT

*Salmo gairdnerii gairdnerii*



## DISTINGUISHING CHARACTERISTICS

*Adults returning to spawn:* The back and upper sides are usually gray. The sides become silvery toward the belly, which is white. There is very little reddish or violet on the sides or fins of fresh-run steelhead. Typically they are bright, silvery fish with relatively few spots along the back and on the dorsal and caudal fins.

*Adults at spawning time:* After the adults have been in the streams and rivers for several weeks their coloration becomes more like that of resident rainbow. They become much darker gray, the spotting becomes much more profuse, and often the side of the head and the lateral band become bright red.

*Young fish before entering the sea:* The colors are similar to those of the nonmigratory rainbow. The back is blue or olive gray, becoming silvery on the sides and white on the belly. The spots are numerous and vary from medium size to tiny specks. The dorsal and caudal fins are similarly spotted, but the other fins are usually unspotted. The ventral and anal fins are frequently pinkish. The dorsal and anal fins may be white tipped. The lateral band is not conspicuous, but may be light iridescent pink or violet.

The steelhead rainbow illustrated above is an adult fish returning from the ocean to spawn. The body spotting is often less pronounced than in the specimen shown here. A young steelhead which has not yet entered the sea will look more like the rainbow shown in the illustration on page 41.

## DISTRIBUTION IN CALIFORNIA

Steelhead rainbow may be found in most of the streams flowing into the ocean, from San Luis Obispo County north. In general, steelhead spawn in the smaller streams, rather than the main rivers. Frequently there are

barriers which prevent adult fish from reaching the spawning areas. Even when no such barriers exist, they rarely ascend to the headwaters, where the nonmigratory rainbow is commonly found.

### INTERESTING FACTS

The steelhead and the golden trout are the two most glamorous trout in California. The golden is known for its beauty and the steelhead for its quality as a game fish. Anyone who has taken a fresh-run steelhead on a fly and light tackle will never forget the experience.

A great many young steelhead are caught in fresh water before they have migrated downstream to the sea. These fish are commonly less than eight inches long and, of course, are not able to put up much of a battle. They usually enter the ocean when they are one or two years old and then spend from one to three years in the sea. When they come back to spawn they nearly always return to the stream in which they were hatched. At that time they may weigh from two to twelve pounds or more.

During the winter or early spring the spawning fish reach suitable gravel riffles in the upper sections of streams and dig their nests.

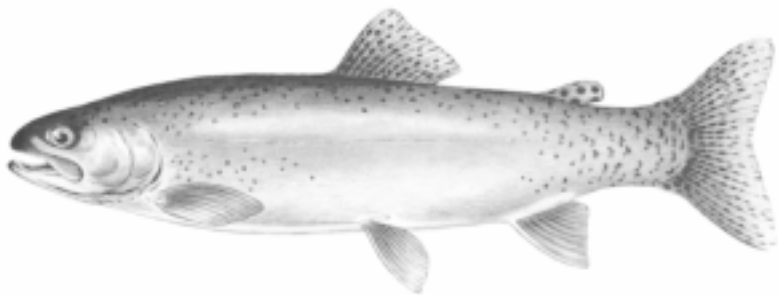
This trout was described by Sir John Richardson from individuals caught near the mouth of the Columbia River in 1836 and was named for Dr. Meredith Gairdner, a naturalist in the employ of the Hudson's Bay Company.



*The beautiful Smith River in Del Norte County is California's most northerly steelhead stream.*

## EAGLE LAKE RAINBOW TROUT

*Salmo gairdnerii aquilarum*



### DISTINGUISHING CHARACTERISTICS

*Male at spawning time:* In describing the Eagle Lake trout, J. O. Snyder stated: "Body above and down the sides nearly to the lateral line is a rich dark olive, each scale brassy and very conspicuous. The sides below the olive region and the ventral surface are deep coppery-red with bright metallic reflections. The sides of the head are cherry-red, very rich in color. A trace of red beneath the mandible; iris brassy. The pectorals are broadly and conspicuously edged with olive."

There are very few black spots on the head. The middle of the back from the head to the dorsal fin is without spots. The dorsal and caudal fins and the upper part of the body have large rounded or elongated spots.

*Female at spawning time:* (Again, from description by Snyder.) "It is light olive above where each scale is silvery with greenish reflections. The sides are lighter, the scales more green than those above, the ventral surface silvery, tinted with pink. A very distinct pale reddish stripe extends along the side of the body, mostly below the lateral line. The cheeks and opercles are red, the iris orange. The ventrals and anal are suffused with red and distinctly edged with the same."

### DISTRIBUTION IN CALIFORNIA

Originally this trout occurred only in Eagle Lake, Lassen County, and its tributary, Pine Creek. In recent years it has been transplanted to several waters in Lassen and Modoc counties.

### INTERESTING FACTS

Eagle Lake lies within the Lahontan system, a drainage area of the Great Basin of North America with a number of fishes of unusual interest. However, the lake and its tributary, Pine Creek, are only a few miles distant from the Sacramento River drainage and there has been considerable speculation whether the Eagle Lake trout is more closely related to the cutthroats

barriers which prevent adult fish from reaching the spawning areas. Even when no such barriers exist, they rarely ascend to the headwaters, where the nonmigratory rainbow is commonly found.

### INTERESTING FACTS

The steelhead and the golden trout are the two most glamorous trout in California. The golden is known for its beauty and the steelhead for its quality as a game fish. Anyone who has taken a fresh-run steelhead on a fly and light tackle will never forget the experience.

A great many young steelhead are caught in fresh water before they have migrated downstream to the sea. These fish are commonly less than eight inches long and, of course, are not able to put up much of a battle. They usually enter the ocean when they are one or two years old and then spend from one to three years in the sea. When they come back to spawn they nearly always return to the stream in which they were hatched. At that time they may weigh from two to twelve pounds or more.

During the winter or early spring the spawning fish reach suitable gravel riffles in the upper sections of streams and dig their nests.

This trout was described by Sir John Richardson from individuals caught near the mouth of the Columbia River in 1836 and was named for Dr. Meredith Gairdner, a naturalist in the employ of the Hudson's Bay Company.



*The beautiful Smith River in Del Norte County is California's most northerly steelhead stream.*

## KAMLOOPS RAINBOW TROUT

*Salmo gairdnerii kamloops*



### DISTINGUISHING CHARACTERISTICS

While these fish are young, they have a distinctive appearance, but as they become older they are more difficult to distinguish from other subspecies of rainbow. In the smaller fish the tail is distinctly forked, the eye is relatively large, the parr marks are clearly defined, and the spotting is limited to the back. However, these characteristics are all relative and cannot be appreciated fully without having the other kinds of rainbow for comparison.

“The typical silvery fish of large lakes is bluish above, with light silvery sides and belly. The spots are comparatively small and v-shaped, and are located chiefly above the lateral line, although there are a few below the line in front, but more posteriorly on the caudal peduncle. There are also a few rounded spots on the top of the head and behind the eye. The dorsal and caudal fins are spotted; the anal usually has a few spots at the base and the pectoral on the anterior ray; the ventral is usually without spots. Except for the spots, the fins are white or faintly clouded. The chin and lower jaw are usually quite black.” The preceding description is given by J. R. Dymond for Kamloops of large lakes in their homeland of British Columbia.

The Kamloops rainbow in the illustration above is a yearling or a two-year-old fish. These young fish have a much more streamlined body shape than do those which have grown old and heavy bodied.

### DISTRIBUTION IN CALIFORNIA

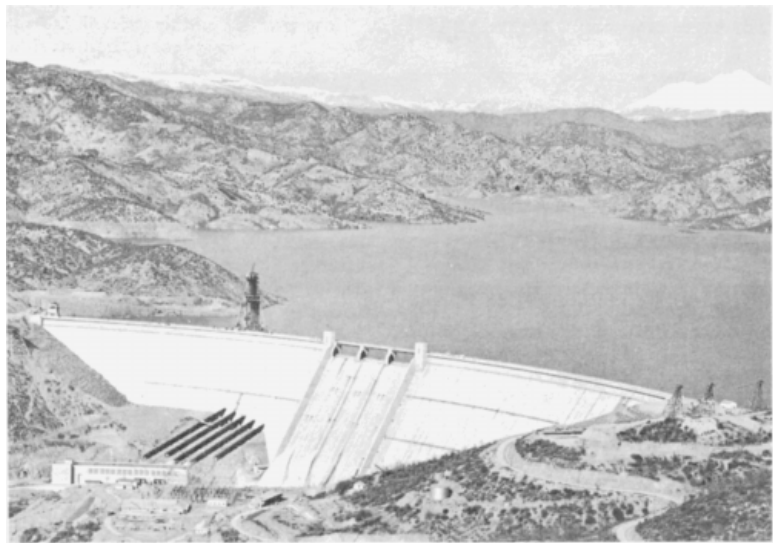
The Kamloops rainbow was introduced into California in June, 1950, when 1,000 yearlings were released in Shasta Lake, Shasta County. Since that time, other plants have been made, but their distribution is still limited.

## INTERESTING FACTS

The Kamloops rainbow were brought to California from British Columbia by the sportsmen of Redding, Shasta County, on the strength of the reputation which they had gained in Idaho and British Columbia. A number of individuals weighing over 30 pounds have been caught by anglers in Lake Pend Oreille, Idaho. The record fish weighed 37 pounds.

The smaller Kamloops will take a fly very readily and put up a spectacular battle. In British Columbia they are regarded as equal to fresh-run steelhead rainbow in their fighting ability.

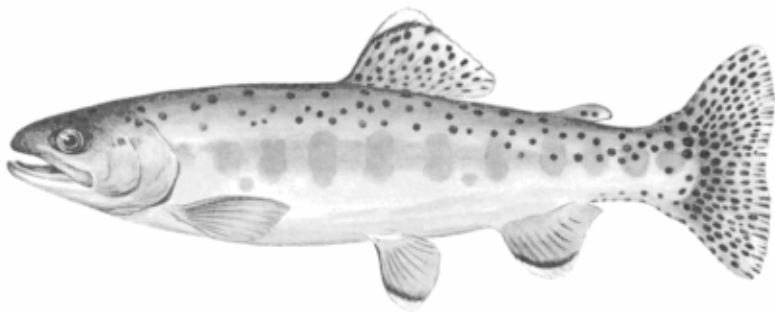
This trout was originally described by David Starr Jordan in 1892 from specimens caught in Kamloops Lake, British Columbia.



*Shasta Lake, first California home of Kamloops rainbow trout.*

## **GOLDEN TROUT**

*Salmo aguabonita*



### **DISTINGUISHING CHARACTERISTICS**

The typical golden trout is a highly colored fish with distinctive shades of yellow and red on the lower sides and belly. The cheeks and opercle often are red, as are the pectoral, ventral, and anal fins. The dorsal and anal fins usually have distinct white tips, sometimes bordered with black.

The spotting is distinctive, there being a relatively few round black spots well defined against the clear background. The spots on the dorsal and caudal fins are also distinct.

The parr marks are distinct, not only on the young fish but commonly on the adults as well. This is usually a good distinguishing characteristic.

Although typical golden trout are easy to distinguish from other trout, there is a great deal of variation in their coloration and spotting. Some golden trout will be found to have many more spots than shown in our illustration, while others have fewer, sometimes confined to the caudal peduncle and tail.

### **DISTRIBUTION IN CALIFORNIA**

Originally golden trout were limited to a few streams in the upper Kern River drainage, at elevations of from about 6,300 to 10,500 feet. Beginning at an early date, man has extended their distribution, by transplanting wild fish or stocking hatchery-reared fish. Golden trout are now present in California in a number of streams and lakes of the Sierra Nevada from Alpine and El Dorado counties to the north to Inyo and Tulare counties to the south, mostly at elevations over 8,000 feet. In recent years they have also been introduced into waters in Siskiyou and Trinity counties.



## INTERESTING FACTS

The extremely beautiful coloration of the golden trout has resulted in their being named the State Fish. Moreover, these fish are usually found in streams and lakes of great beauty.

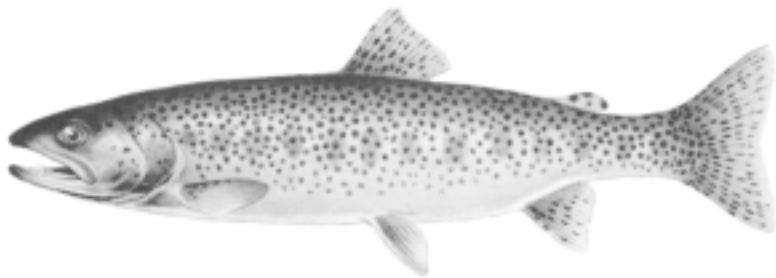
This trout was originally described by David Starr Jordan in 1892 from specimens taken in Cottonwood Creek, Inyo County. However, it was not originally native to Cottonwood Creek, but had been brought there in 1876 from Mulkey Creek, a tributary of the South Fork of the Kern River. The greater number of black spots, and especially the presence of spots below the lateral line, is said to distinguish *S. a. whitei*, native to the Little Kern River watershed, from *S. a. aguabonita*.



*Bighorn Lake, Fresno County, a typical golden trout lake—Photo by Phil Pister.*

## COAST CUTTHROAT TROUT

*Salmo clarkii clarkii*



### DISTINGUISHING CHARACTERISTICS

The back is usually dark olive green. The sides are much lighter and the belly is silvery white.

Usually a pair of red streaks, the cutthroat marks, are present on the membrane between the jawbones.

The entire body and all the fins are usually spotted with large, distinct, black spots or irregular marks. However, the spotting does not extend to the lower sides and belly of all fish.

In addition to the cutthroat marks and the heavy spotting, at least three other characteristics serve to distinguish cutthroat trout from rainbow trout. In the cutthroat, the maxillary tends to be longer; the numbers of scale rows along the sides are greater (in other words the scales are smaller); and there are usually teeth on the base of the tongue. Although these three characteristics are frequently very helpful in identification, they cannot be depended upon in all cases.

### DISTRIBUTION IN CALIFORNIA

The coast cutthroat is found in the lower courses of most coastal streams from the Eel River northward. It is not generally abundant and seems to have difficulty competing with the rainbow. Limited numbers of sea-run cutthroat occur in these streams, but are somewhat difficult to distinguish from sea-run rainbows and so are often overlooked.

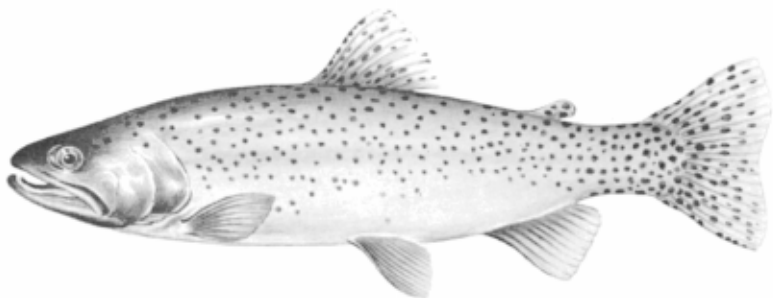
### INTERESTING FACTS

Like the Dolly Varden, the coast cutthroat is a northern trout whose range extends only a short distance into California. It might be called the "redwood trout", for most of the California streams in which it lives are shaded by these giant trees.

This trout was originally described in 1836 by Sir John Richardson from fish caught in the Cathlapootl River in Oregon. It was named for Captain William Clark of the Lewis and Clark Expedition.

## LAHONTAN CUTTHROAT TROUT

*Salmo clarkii henshawi*



### DISTINGUISHING CHARACTERISTICS

The body is usually a dark, yellowish-olive color from back to belly. The side has a broad pinkish stripe. The sides of the head are often scarlet.

The entire body is covered with large, black spots.

Cutthroat living in deep water may be silvery with narrow, elongated spots.

There are two distinct red stripes on the membrane beneath the jaw. The Lahontan cutthroat shown in the drawing above is an old male with a heavy body, and a relatively humped back. Very often this species is more slender. Also, it should be noted that the black spots on the body are not always as numerous as shown here.

### DISTRIBUTION IN CALIFORNIA

In California the Lahontan cutthroat is a native of the Truckee, Walker, and Carson drainages and does not occur naturally in waters draining into the Pacific Ocean. This range has been extended somewhat by hatchery planting.

### INTERESTING FACTS

This fish has been known as the Tahoe trout, for it was very abundant in Lake Tahoe until it became extinct or virtually so in the 1940's. Very large individuals ascended the tributary streams to spawn in April. Years ago there was a considerable market fishery for this fish, which was known as the "black-spotted trout". The most likely reason for its extinction was the introduction of the lake and rainbow trouts, although insurmountable irrigation dams on the Truckee River and the market fishery may well have been contributing factors.

## PIUTE CUTTHROAT TROUT

*Salmo clarkii seleniris*



### DISTINGUISHING CHARACTERISTICS

Highly colored individuals could be mistaken only for golden trout. However, they can hybridize with rainbow and Lahontan cutthroat and such hybrids may be considerably spotted.

The ventral surface is usually a clear white, making a contrasting background for the orange-red cutthroat marks beneath the jaw.

The parr marks (dark splotches along the sides) in the highly colored individuals are distinct, similar to those of golden trout.

### DISTRIBUTION IN CALIFORNIA

The native habitat of this trout is restricted to upper Silver King Creek and its tributaries above Llewellyn Falls, an impassable barrier situated at the lower end of Fish Valley. Silver King Creek, a tributary of the East Carson River, is located in a remote region of Alpine County, east of the Sierra Divide. The Department of Fish and Game has transplanted some Piute cutthroats to other waters to insure the survival of the species, which is threatened by hybridization with planted rainbows.

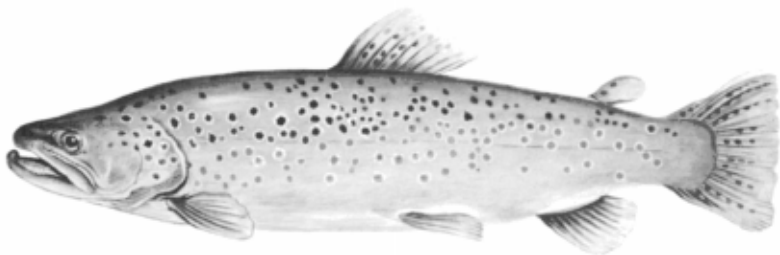
### INTERESTING FACTS

The Piute is a cutthroat trout which was separated a great many years ago from the Lahontan cutthroat living in the Carson River drainage below the falls. Through the centuries it developed a pattern of coloration which is very similar to that of golden trout.

This trout was originally described in 1933 by J. O. Snyder from specimens obtained in Fish Valley, Alpine County. It was named *seleniris* for its resemblance to the rainbow of the moon.

## BROWN TROUT

*Salmo trutta*



### DISTINGUISHING CHARACTERISTICS

The coloration of brown trout is quite variable; usually they are dark brown or olive brown on the back, shading to golden brown on the sides and to white or yellow on the belly.

There are dark spots on the head, body, and dorsal fin. These spots are relatively large and distinct. There are no wavy markings on the back or dorsal fin.

There are red spots on the lower sides, each surrounded by a light halo. There is a great deal of variation in the number and size of the dark and the red spots in the brown trout of California, *but this is the only trout with both black and red spots on its body.*

Some brown trout from lakes are very pale, almost silvery, on their sides and belly. "Sea-run" browns returning to certain rivers from the ocean are quite silvery, resembling steelhead, and may be without red spots.

The scales are large enough to be seen easily, though in very large individuals they may become imbedded in the skin.

The brown trout in the illustration above is a very heavy old male. In such fish the posterior part of the body is very deep, and the lower jaw is hooked. Younger fish are much different in body proportions. (See illustration, page 41.)

### DISTRIBUTION IN CALIFORNIA

The brown trout is widely scattered throughout California. However, the waters in which it is abundant are relatively few. In past years this species was planted in a large part of all the trout waters of the State, but in recent years only a few selected lakes and streams have been stocked with browns. A few browns, progeny of earlier plants, can still be found in many lakes, reservoirs, and streams in California, and in a good many streams along both sides of the Sierra the "brownie" spawns quite successfully.

## INTERESTING FACTS

A characteristic of the brown trout is its wariness, and those who can catch the brownie rate him as a “fisherman’s fish”. The strain of brown trout brought to California many years ago never lost its canny Scotch disposition, but another strain imported from Massachusetts in 1954 apparently had some of its wariness bred out through the years and is much easier for the average angler to catch.

Because of his disposition, the brownie escapes his enemies and often lives to a ripe old age. He also grows to a considerable size and record trout caught from time to time are usually browns.

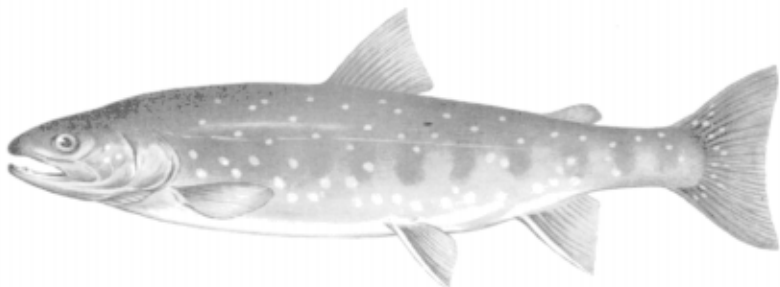
This trout was originally described in 1758 from native European fish by the great naturalist Linnaeus. The specific name *trutta* is the Latin for “trout”.



*These large brown trout were netted by Department of Fish and Game personnel out of Convict Lake, Mono County, on November 3, 1953. This was done to reduce cannibalism and give the other trout a better chance to survive.—Photo by Phil Pister.*

## DOLLY VARDEN TROUT

*Salvelinus malma*



### DISTINGUISHING CHARACTERISTICS

The back and sides are olive green or muddy gray, shading to white on the belly.

The body has scattered pale yellow or pinkish-yellow spots. There are no black spots or wavy lines on the body or fins.

Small red spots are present on the lower sides. These are frequently indistinct.

The fins are plain and unmarked except for a few light spots on the base of the caudal fin rays.

### DISTRIBUTION IN CALIFORNIA

The McCloud River below the lower falls and the reservoirs connected with it are the only waters in California in which this species is found. The Dolly Varden is rather widely distributed in the Pacific drainages of Oregon, Washington, Idaho, Montana, British Columbia, and Alaska.

### INTERESTING FACTS

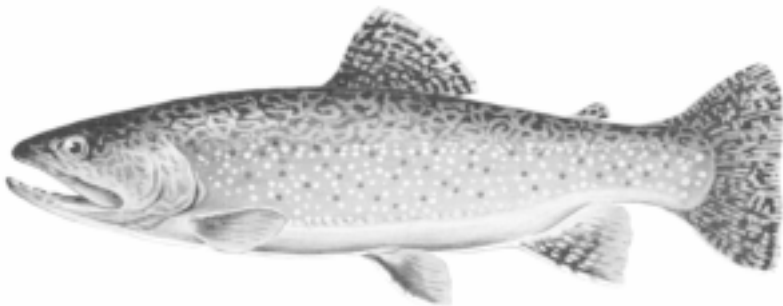
Perhaps the most interesting thing about the “dolly” is that in California it lives only in the McCloud River. There have been unverified reports of its occurrence in both the Sacramento and Pit rivers, in the same drainage, but at the present time at least it appears that this, our only native char, is restricted to the McCloud.

The way the Dolly Varden got its name is also of some interest. Though the fish is widely spread to the north of California the name originated here. In a publication by Evermann and Bryant in 1919, it is stated that: “When this fish was taken by scientists in the McCloud River, the resemblance to a dress goods with spots called Dolly Varden, and which was then the rage, led to its being given this name by the lady members of the party, and ‘Dolly Varden’ it has been ever since.

This trout was originally described in 1792 by Johann Walbaum from fish caught in Kamchatka, and called *malma*, a vernacular name in Kamchatka.

## **EASTERN BROOK TROUT**

*Salvelinus fontinalis*



### **DISTINGUISHING CHARACTERISTICS**

The back and sides are usually dark olive green. Light spots on the sides are large and nearly round. On the back the light spots turn to wavy lines, which are very characteristic of the brook trout.

The dorsal fin has dark wavy lines rather than spots. This is a good distinguishing characteristic.

There are usually red spots on the sides, but these may be indistinct in some brook trout from lakes.

The ventral and anal fins usually have distinct white borders along the anterior margins.

Brook trout at spawning time usually have considerable orange-red on the belly. This is more pronounced in the males and at such times they are extremely colorful.

The scales are very small and not easily seen.

The brook trout shown above is a male at breeding time. Females have shorter jaws, and younger fish have somewhat different body proportions. (See illustration on page 41.)

### **DISTRIBUTION IN CALIFORNIA**

The eastern brook trout has been scattered by hatchery planting from the San Bernardino Mountains of southern California northward to the Oregon line. A large part of the waters in the State have been planted with this species, but it has not become well established except in high mountain lakes and in the small streams of mountain meadows. It does not do well in California waters lying much below 4,000 feet and is found more commonly at elevations between 5,000 and 9,000 feet.



## INTERESTING FACTS

This trout is particularly well fitted for life in those mountain lakes of California which have no permanent tributary streams in which fish can spawn. The eastern brook trout does not require stream water and can spawn very successfully in springs on lake bottoms. Most lakes have some such springs and an initial planting of fingerlings is often enough to establish the fish; from then on, natural propagation may be sufficient. For some reason, this species of trout does not grow to as large a size in California as it does in many parts of the East. There may be some who will disagree, but it is generally conceded that pan-size brookies from our high mountain lakes can be the finest flavored of all our trout. The reason the official name is eastern brook trout is because it was brought to California from the eastern United States. In early-day California, native rainbow in small streams were often called brook trout and so it seemed wise to call the importation eastern brook trout.

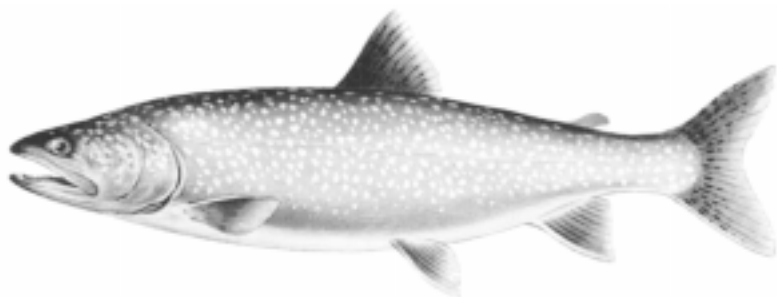
This trout was originally described by Samuel Mitchell in 1815 from fish caught near New York City and named *fontinalis*, which means "living in springs".



Castle Lake, Siskiyou County, with Mt. Shasta in the background. This 48-acre lake contains both rainbow and eastern brook trout. It is an experimental lake of the California Department of Fish and Game in which management techniques are field tested.

## LAKE TROUT OR MACKINAW

*Salvelinus namaycush*



### DISTINGUISHING CHARACTERISTICS

The background color of the body is usually dark gray, but varies from pale to almost black.

The entire body except for the belly is covered with large pale spots.

The dorsal and caudal fins are marked with dark wavy lines and spots.

The caudal fin is deeply forked. The head is pointed and the body is relatively slender. The lake trout illustrated above is an exceptionally plump fish. Very often they are more slender.

### DISTRIBUTION IN CALIFORNIA

Self-sustaining populations of lake trout are present in Lake Tahoe, Fallen Leaf Lake, Stony Ridge Lake, and Donner Lake, all of which are in the Truckee River drainage. Lake trout have recently been introduced into other waters.

### INTERESTING FACTS

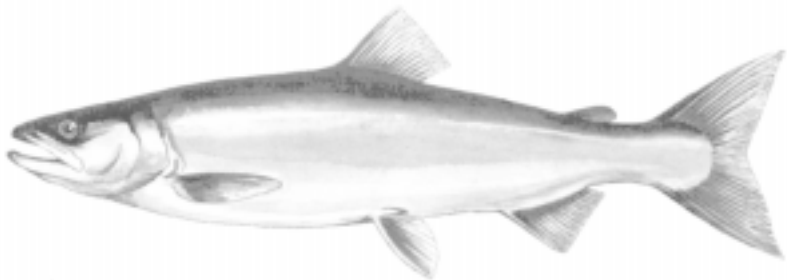
This trout tends to live in the deeper pans of lakes and is usually caught by trolling with wire line, to which large spinners and frequently minnows are attached. It commonly feeds upon other fish and grows to large sizes; 15 pounds is not rare. This is the only trout which does not construct some sort of nest and cover its eggs with gravel. Its eggs are dropped into the loose rock or ledges and shelves on the lake bottom.

The lake trout or mackinaw, as it is often called in California, was brought to this State from Michigan in 1894. It has not been widely distributed because of its tendency to feed upon other trout. It is sometimes blamed for the disappearance of the Lahontan cutthroat from Lake Tahoe.

This trout was originally described in 1792 by Johann Walbaum from fish taken in Hudson Bay and called *namaycush*, an Indian name.

## KOKANEE SALMON

*Oncorhynchus nerka*



### DISTINGUISHING CHARACTERISTICS

The back is a dark blue and the sides are silvery. As the spawning season approaches, both male and female kokanee turn a deep red, and the lower jaw of the male develops a characteristic hook common to Pacific salmon. Rays in anal fin 13 to 17 (usually 14 or 15), opposed to 9 to 12 (rarely 13) in trout.

### DISTRIBUTION IN CALIFORNIA

Kokanee have been planted in 35 lakes in California since their initial introduction in 1941 but have established self-perpetuating populations only in 10. Donner Lake, for example, has a good population of kokanee, limited now by spawning area.

### INTERESTING FACTS

Kokanee are not trout but belong to the same family as the trout. Since they look like trout and are found in the same areas, we have included them here so that anglers may be able to identify them.

Kokanee are primarily plankton feeders, found in the open water areas of a lake. They like the same cool waters preferred by trout. Kokanee compete with small trout for food but provide forage for large lake trout.

Mature kokanee ascend streams and gather over gravel bars in lakes in the fall to spawn. Kokanee are the landlocked form of sockeye salmon and, like their ocean-going brothers, die after spawning.

Kokanee can be caught with flies, bait, or lures. When trolling, a rubber band between line and leader prevents the hook from tearing out of their soft mouths.

*Oncorhynchus nerka* was originally described by Walbaum in 1792 from sockeye taken in Kamchatka. The scientific name is Greek for "hooked nose of flowing waters"

# MOUNTAIN WHITEFISH

*Prosopium williamsoni*



## DISTINGUISHING CHARACTERISTICS

The sides are silvery, while the back and fins are light brown. The small mouth superficially resembles that of a sucker. Whitefish can be immediately distinguished from suckers by the presence of an adipose fin, which is one indication of their ties with the trout and salmon.

## DISTRIBUTION IN CALIFORNIA

The mountain whitefish is found throughout the streams and lakes of the eastern slope of the Sierra Nevada, but is most common in the Truckee and Carson rivers.

## INTERESTING FACTS

Whitefish are often taken by trout anglers, since they are found in the same waters as trout and eat much the same food. Many anglers have discarded them as suckers or as inedible fish. Neither of these assumptions is correct. Whitefish are as good to eat as trout and are not at all hard to distinguish from suckers if one remembers to look for the adipose fin. Ironically, a true sucker of the Truckee River develops a red stripe on its sides and is often taken home as a rainbow trout by anglers who would throw away whitefish.

Whitefish may grow to a weight of six pounds, although fish over two pounds are rare.

Whitefish spawn in the fall in the gravel of stream riffles. The eggs develop in the stream in winter and take about five months to hatch at 35 degrees Fahrenheit.

Whitefish may be taken by anglers only during the trout season. Generally, the same regulations apply. We hope that their inclusion here with the trout will identify them to more anglers and prevent waste of this fine game fish.

## **TROUT HYBRIDS**

Certain species of trout hybridize readily, while others do so infrequently. In some crosses, only a small percentage of the eggs develop beyond the egg or fry stages.



### **SPLAKE TROUT**

The “splake” trout is a cross between the eastern brook trout and the lake trout. Splake were first produced successfully for angling in certain Canadian lakes and since then have been tested in various parts of the United States.

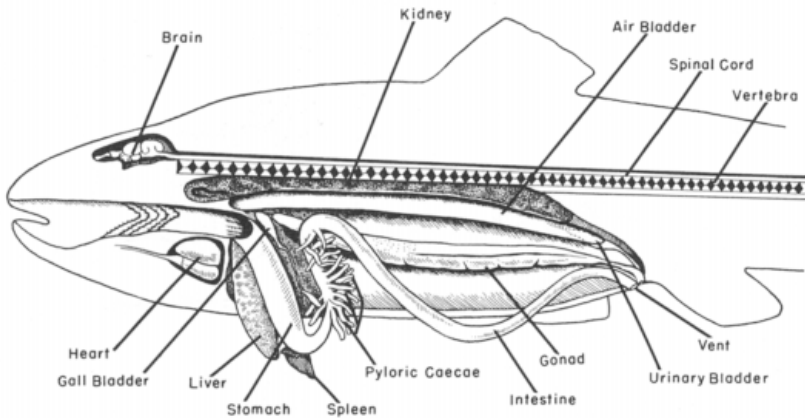
Another hybrid is the “tiger” trout, a cross between the brown and the brook. It derives its name from its peculiar stripes, as well as its voracious eating habits. Relatively few eggs of this cross are fertile. Despite its rarity, a few “tiger” trout have been found in nature in northern California. The one shown in the accompanying photo was 8½ inches long when it was caught in 1957 in Squaw Valley Creek, a tributary of the McCloud River in Shasta County.



### **TIGER TROUT**

Rainbow and golden trout cross in nature. So do rainbow and cutthroat. Not only are they related but, perhaps more important, their spawning time is about the same and they tend to spawn in the same type of stream gravel. So, when they are living in the same waters it is not unusual for them to cross.

# LIFE STORY OF THE TROUT

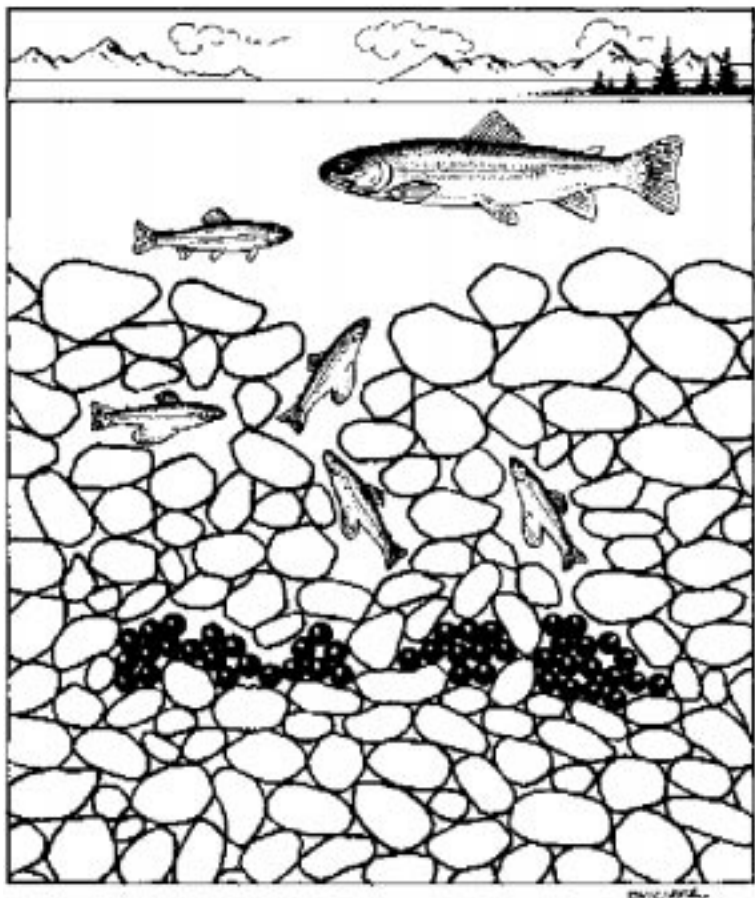


*The internal organs of a trout*

## SPAWNING

*Rainbow trout.* Wild rainbow generally spawn in the spring, usually February through June, but there are exceptions to this, as there are to almost everything else that trout do. Some strains of domesticated rainbow in our hatcheries have been bred to spawn in the fall, so that their offspring will be larger at planting time.

The place of spawning for rainbow is in streams, usually the smaller, swifter streams of clear, cool, unpolluted water. The male and female meet at some point in the stream where the size and depth of the gravel are satisfactory. The gradient of the stream bed and the depth and velocity of the water must meet certain requirements, for it is necessary that the flow of water through the gravel be sufficient to keep the eggs well oxygenated and free of smothering silt. Once the pair of spawners has found the gravel bed which fulfills all of their requirements, the female proceeds to dig a pocket, into which she will deposit her eggs. With strong flips of her tail, she throws aside the gravel until a depression has been formed. A large steelhead rainbow weighing 10 pounds may dig a pocket measuring two feet long, a foot wide, and 10 inches deep, while small "resident" rainbow of the mountain brooks will dig much smaller pockets corresponding to their size.



Trout eggs are *buried* in the gravel of a stream bed, several inches beneath the surface. When they hatch, the fry (alevins) remain in the spaces between the gravel until the yolk sac is absorbed. At that time they work their way up to the surface and escape.

Once the pocket has been completed, the female, with rapid, vibratory contractions of her body muscles, expels a part of her ripe eggs and as they spurt forth the male ejects a stream of white milt into the gravel pocket with the eggs. Even though the water flows swiftly over the depression, the back eddy formed within the pocket holds the eggs and the sperm together until the female can cover them with loose gravel. In the meantime, the soft eggs are absorbing water and soon become perfectly round. Within the first few seconds after spawning, one of the many thousands of spermatozoa released by the male fish has entered the egg through a minute opening called the micropyle and fertilization is completed.

Into the first gravel pocket the female and the male have put only a part of their eggs and milt. She must dig more such pockets into which more eggs are laid and fertilized. Normally, these pockets are dug one upstream from the other, so that in forming the second depression the gravel is washed down and helps cover the first pocket formed. The completed series of covered pockets is called a redd.

The size and number of trout eggs vary in more or less direct relation to the size of the female. A six-inch trout of a small tributary stream will lay 200 or 300 small, amber-colored eggs, while a large steelhead may produce 6,000 or more.

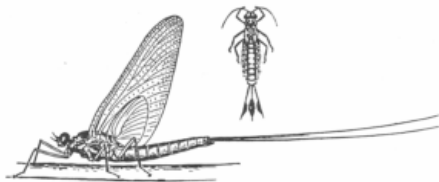
Other kinds of trout have spawning habits which are more or less similar to those of the rainbow. Some differences have been mentioned elsewhere in the booklet. The lake trout and the eastern brook trout are the only trout which commonly spawn in lakes. All of the others spawn in streams. The time of spawning for the cutthroat, Piute, and golden is in the spring and early summer; for the brown, brook, Dolly Varden, and lake trout it is in the fall.

## DEVELOPMENT OF TROUT

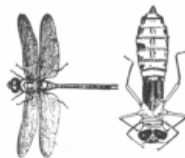
*The egg.* After trout eggs have been deposited and fertilized, they are usually covered with gravel, although in the case of the lake trout the eggs are simply dropped into the crevices of broken rock. Any developing egg must have oxygen and it is essential, therefore, that trout eggs be kept free of silt and be continually bathed by fresh, well aerated water. Most types of pollution are harmful and sometimes lethal to developing trout eggs and one of the important functions of any conservation agency is to see to it that trout waters are not polluted.

The length of time required for a trout egg to hatch largely depends upon the water temperature. Rainbow eggs will hatch in 80 days when the water averages 40 degrees Fahrenheit. If the temperature were 55 degrees, they would hatch in 24 days. Those eggs which are laid in the fall, when the water is cold, nearly always remain in the gravel all winter and hatch in the spring or early summer when temperatures increase. At hatching time the egg shell breaks open and the little fish emerges carrying its sac of yolk and for several weeks that is all the food it has to live on. When the yolk has been absorbed, the fry work their way up through the gravel and start to look about for tiny aquatic animals to eat.





*Spring Mayfly and Nymph*

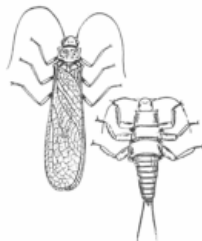


*Green Darner and Nymph*

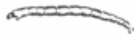
## **These Insects Are 'Bread and Butter'**



*Blue Darner Dragonfly and Nymph*



*Late Spring Stonefly and Nymph*



*Midge and Larva*



*Caddis-Worm in Its Case  
and the Caddisfly*



*Chromagrion Damselfly and Nymph*



*Water Boatman*



*Black Dragon and Nymph*

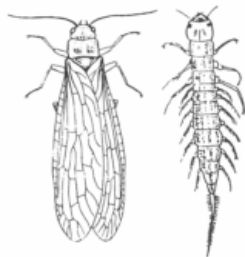


*Backswimmer*



*Pale Green Mayfly and Nymph*

## in the Diet of California's Trout



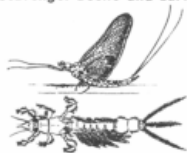
*Alderfly and Larva  
(Hellgrammite)*



*Crane Fly and Larva*



*Water Scavenger Beetle and Larva*



*Eel Fly and Nymph*



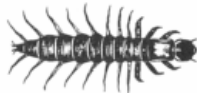
*Dobsonfly and Larva  
(Hellgrammite)*



*Mosquito and Its Larva and Pupa*



*Fishfly and Larva*



*The fingerling.* Now that the young trout is on its own and can no longer depend upon yolk for food, it becomes known as a “fingerling” and this is the name applied until it is a year old when, quite naturally, it is called a yearling. Trout, both small and large, eat a great variety of foods. Now and then, bits of plant material can be found in their stomachs, but ordinarily they are carnivorous. Insects of one kind or another are the preferred foods after the fish are large enough to eat them. The larger brown trout, the mackinaw, and the steelhead in the ocean may feed to a large extent on other fish. But there are so many exceptions that it is unwise to generalize. Some very large trout feed almost entirely on the minute forms of plankton. On the other hand, a fingerling trout can often be found with a smaller fingerling in its mouth. It is quite correct to say that trout will eat almost anything, but insects are the “bread and butter” of their diet.

As the young trout eats, it grows; but the speed of its growth may vary from three inches or less to over a foot a year. It is difficult to tell how old a trout is by its size, because there are many factors which influence the rate of growth. The amount a trout eats can vary widely and depends largely upon the amount of food available, the temperature of the water, and the size of the body of water it is living in. As an example, a “resident” rainbow which spends all its life in a small pool in a cold, mountain brook will not eat as much food in an entire year as its steelhead cousin may eat in a week. Naturally, its growth will be very slow. It may be 3½ inches long by the end of its first year and perhaps only five inches long by the time it is two years old. Its cousin, who has gone to the ocean at about the end of its first year, may grow to be 16 inches long and reach a weight of 1½ pounds in the time it has taken the stream rainbow to grow to five inches. In some rich lakes, such as Lake Almanor in Plumas County, a rainbow planted as a two-inch fingerling one summer may be 14 inches long a year later. There are a few large lakes in the world in which rainbow reach a weight of 16 pounds in four years. In many cases where growth is very rapid we find the trout eating smaller fish almost exclusively and the water temperature remaining somewhere in the neighborhood of 60 to 65 degrees Fahrenheit. In colder water the appetite of trout diminishes.

*The adult.* Fish, unlike birds and mammals, never entirely stop growing. Most trout die from one cause or another long before they reach their maximum life span and only the exceptional fish will attain a large size.

*Young rainbow, brown, and eastern brook trout. Note differences in marking and compare these illustrations of young trout with drawings of older specimens.*



*Rainbow Trout—4½ inches long*



*Brown Trout—4½ inches long*



*Eastern Brook Trout—3¾ inches long*

## ***Some Record Trout Caught With Rod and Reel***

WORLD RECORD				CALIFORNIA RECORD		
Species	Place caught	Pounds and ounces	Year	Place caught	Pounds and ounces	Year
Rainbow	British Columbia	36	1954	Feather River	21-3	1926
Steelhead Rainbow	Wyoming	11	1948	Smith River	21-6	1948
Golden	Nevada	41	1925	Virginia Lake	9-14	1952
Lahontan Cutthroat	Loch Awe, Scotland	39-8	1866	Lake Tahoe	31-8	1911
Brown	Lake Pend Oreille, Idaho	32	1949	Regulator Lake	24	1945
Eastern Brook	Ontario	14-8	1916	Silver Lake	9-12	1932
Dolly Varden	Lake Pend Oreille, Idaho	37	1947	McCloud Reservoir	9-1*	1968
Lake	Lake Superior	63-2	1952	Lake Tahoe	32-12	1926

\*Dressed weight; in the round this fish probably weighed 10 pounds or more. Dolly Varden trout weighing over 10 pounds have been reported from the McCloud River but these reports have not been fully verified.

Certainly only "one in a million" trout will reach the maximum age for any particular species and it is difficult to say how old trout might live to be if a violent death or some disease did not intervene. In the following table are listed some of the oldest trout for which there are records.

### ***Oldest Known Trout***

Species	Where found	Age in years
Rainbow	Michigan and Canada	7
Steelhead Rainbow	Oregon	9
Eagle Lake Rainbow	California ( <i>Eagle Lake</i> )	11
Kamloops Rainbow	British Columbia	7
Golden	California ( <i>Cottonwood Lakes</i> )	6
Cutthroat	Oregon	10
Brown	Scotland	18
Eastern Brook	California ( <i>Bunny Lake</i> )	19
Dolly Varden	California ( <i>Mt. Shasta Hatchery</i> )	19
Lake	Northwest Territories	41

As one would expect, trout vary greatly in their age at first spawning. Some trout produce their first lot of eggs when only two years old; it is common for them to mature in three years; others may take longer. Usually trout spawn once a year until they get quite old, although they may miss a year now and then. At one California trout hatchery a few rainbow females spawned twice in one year, but that was the first time such an event had been recorded in the United States.

## **TROUT SENSES**

Although much is known about the senses of sight, hearing, taste, smell, and touch in trout, a good deal remains to be learned.

## **SIGHT**

In its general form the eye of a fish is not unlike that of land vertebrates, but it is necessarily somewhat modified for vision under water. As most anglers know, trout do see quite well.

“Can trout distinguish colors?” It is an old question that was partially answered by tests conducted by Department of Fish and Game biologists. Trout can distinguish certain colors. They respond to red and all shades of red, including light pink. Perhaps they can distinguish many other colors too, but in these tests they were attracted only by red. The tests also proved conclusively that trout can see and are attracted by red objects entirely out of the water.

## **HEARING**

Although fish have no external or middle ear, they can respond to vibrations of the water and so do “hear”. The swim bladder is the main sound receiver, transmitting its vibrations to the inner ear, but the lateral line system is also a hearing organ. The latter is particularly sensitive in the low-frequency and subsonic range, and at short distances it can locate sound sources. The internal ear of a trout is well developed and operates in essentially the same manner as it does in humans. Thus, trout have a good sense of balance. The lateral line of a trout can be seen as a series of pores in the scales along each side. These pores open into tubes in the scales and one tube connects with the next, forming a continuous canal extending from the head to the tail. The canal is filled with mucus, which conducts vibrations to the nerve endings beneath. These nerve impulses, caused by vibrations in the water, are carried to the brain by a long nerve extending along the side of the fish beneath its skin.

## **TASTE**

Fish have a reasonably well developed sense of taste and trout seem to be able to distinguish foods from inedible objects fairly well. A feeding trout will take almost anything into its mouth, but only those objects that taste right will be swallowed. There are taste buds in the mouth of a trout similar to those in higher animals. It is not clear why we find objects such as pine needles, which have no food value, in a trout's stomach. It is doubtful if they taste like food. Some debris found quite often in a trout's stomach comes from the cases of caddis larvae, which are a favorite food. A good trout bait must appeal both to a trout's sense of smell and taste. A fish can sense food by either smelling or tasting the water.

## **SMELL**

The sense of smell in fishes is relatively acute, as has been proved by numerous experiments. Trout are no exception. There is a pair of nostrils on either side of the snout of a trout, but these are not used for breathing.

Water enters one nostril, then passes over several folds of skin and out the other. It is well known that salmon are keenly aware of various odors, including the odors of a man's hand placed in the water. It is likely that trout have as keen or nearly as keen a sense of smell as do salmon.

## **TOUCH**

A fish has nerve endings scattered over most of its body surface and responds to touch stimuli, but its response is often unlike that of man and many other higher animals. This is largely because its brain is not developed to such an extent that the fish can do much "thinking" about its touch sensations. That is why a fish can be stuck by a hook and return in a moment to strike at the hook again. Without doubt it has felt the hook, but whether or not it has felt pain is difficult to say, since we judge such matters only by our own standards.

## **OTHER INTERESTING FACTS**

### **RESPIRATION**

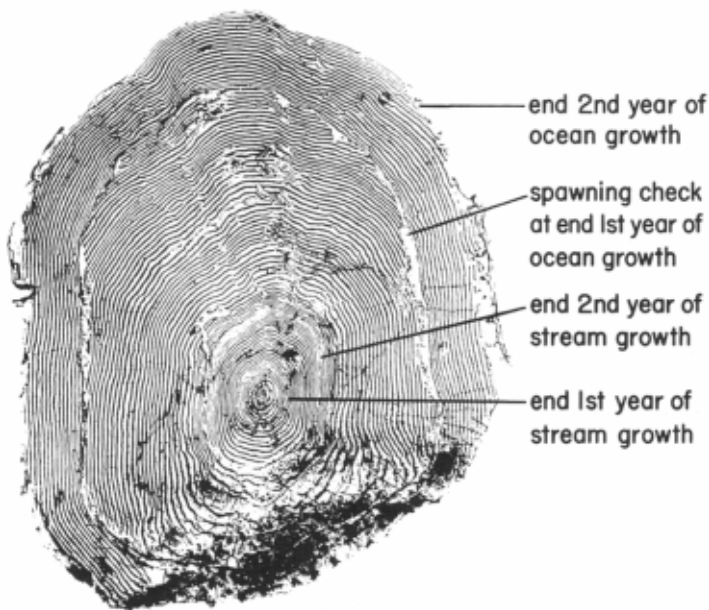
When a fish takes water into its mouth it is breathing, not drinking. The water passes across the hundreds of tiny gill filaments and then out through the gill slits, one on either side of the head. In each gill filament is a capillary through which the red blood cells are continually flowing. There is an exceedingly thin membrane separating the blood from the water, and oxygen in the water is exchanged for the carbon dioxide of the blood. Trout require more oxygen than some other kinds of fish, so we normally find trout living in well aerated waters.

### **SWIMMING SPEED**

Trout are not the swiftest of all fish, but they are certainly not slow. They swim slowly most of the time, but when occasion demands they can develop reasonably high speeds for short distances. Tests have been run to determine the approximate swimming speed of trout, but speeds vary, depending upon the size and species of the trout, the temperature of the water, the health of the fish, and the amount of rapid swimming the particular fish has been doing. In a very general way, a rule of thumb approximation is that the swimming speed of trout in feet per second is equal to their length in inches. Thus, a three-inch trout can swim about three feet per second and a 12-inch trout can swim about 12 feet per second. Three feet per second is a trifle over two miles per hour and 12 feet per second is a little over eight miles per hour. Of course, these speeds can only be maintained for very short distances.

### **THE SCALES OF TROUT**

In many kinds of fishes the scales are the best indicators of age. Under a microscope a fish's scale is found to be marked by many concentric lines, like the growth rings on a tree trunk. When the growth is slow these circuli are close together and, conversely, when the growth is rapid they are far



*A scale from a 28-inch steelhead near the end of its fourth year of life, showing two years of stream life and two years of ocean life, with spawning at the end of the first year of ocean life. The scale was taken from the fish when it returned to the stream to spawn a second time—Photomicrograph (40x) by Leo Shapovalov.*

apart. Fish usually grow rather slowly or not at all when the water is cold in the winter and when food is scarce. Thus, each winter the circuli on the scales are close together and one can count these bands of circuli and tell how old the fish is. When a trout spawns the edge of the scale is often absorbed. After spawning is over and the fish begins to grow again a check which is easily noted by a specialist in this field of study is left on the scale. Thus, one can tell the age, the speed of growth, and the number of times a trout has spawned by studying its scales under a microscope.



## THE COLOR OF TROUT

A highly colored golden trout or an eastern brook trout at spawning time compares favorably with the more brilliantly colored tropical fishes. From these extremes of high coloration trout become less colorful until, in the case of a rainbow from some lakes, the back is dull green and the sides and belly range from silver to pure white. A rainbow from a deeply shaded mountain stream is often quite dark. Even the belly may be dark gray. The black spots, the parr marks, and the fine black stippling found on most trout are caused by great numbers of melanophores or black pigment cells filled with microscopic black pigment granules. Similarly, the red and yellow colors are produced by cells filled with red and yellow pigments.

Trout and many other kinds of fishes are able to change their colors quite rapidly and they do this by contracting or expanding these pigment cells. When thousands of these tiny cells are expanded the pigment granules are spread out and the fish becomes dark or red or yellow, as the case may be. Then, these cells may be stimulated by nerve impulses and made to contract into pin points of black or of color and immediately the fish becomes much lighter.

In addition to this rapid means of modifying color or the intensity of the color, a trout may lose or gain pigment, but this is a relatively slow process. Beneath the skin of a trout is a layer of guanin crystals in cells called guanophores. It is the guanin that gives the trout its silvery appearance. The pigment granules in the chromatophores (black, orange, or yellow) have several different shades of color and different combinations of these shades, together with the guanin, are sufficient to produce all the colors seen in a trout.



*A view of San Joaquin Fish Hatchery, showing Friant Dam in the background. In the foreground are the series of raceway ponds for rearing catchable-sized trout. Beyond these are the garage and food preparation and hatchery buildings.*

## **TROUT MANAGEMENT**

What is trout management and why is it necessary?

Management has come to mean almost everything done to protect trout and improve conditions for them. Seasons and bag limits are part of management, as are the investigations to determine the need for them. So are the rearing and stocking of hatchery trout and habitat improvement.

In a rapidly developing state like California it becomes progressively more difficult to maintain good trout fishing. Statistics show that in 1956 twice as many trout were caught as in 1936, but many more anglers had to share the crop. In 1936, some 149,000 anglers caught trout in California; in 1956 there were 640,000 successful anglers. In 1936, half of the trout anglers caught 50 trout while in 1956 half of the trout anglers caught 21 trout. In 1964 there were 931,000 successful trout anglers in California. Over 1,000,000 anglers spent about 9,000,000 days fishing for trout in 1968.

While angling pressure has been increasing, trout stream habitat has been destroyed or downgraded by the power and irrigation dams, increased logging, overgrazing, and stream pollution that go with an expanding economy. This, of course, has decreased the production of wild fish.

Stocking is the most popular form of trout management and the best known, but the high cost of hatchery fish makes it important to stock them where they will do the most good.

Research to find ways to increase the return of hatchery fish to the angler has been going on for a long time in many parts of the world. It has been shown that stocking fingerling trout in streams is poor business. Returns to the angler are often on the order of two percent of the fish stocked, or less. And the fish caught are usually small. Consequently, the department has embarked on a program of growing trout to catchable size in hatcheries before planting them in heavily-fished roadside waters.

In the case of fingerling steelhead planted in streams, returns to the angler are even lower. However, if the young steelhead are kept in the hatchery, and thus protected from natural hazards until they are about six inches long before they are stocked, returns are much greater.

In lakes the picture is quite different. When fingerling trout are stocked in suitable lakes without many predators, returns may be quite high, because more of the fish survive than in streams, where conditions are more rigorous.

Many California lakes do not have spawning tributaries suitable for trout. Periodic fingerling stocking maintains the trout populations in them at a reasonable cost. This has led to a sizable program of airplane stocking of small fish on about 1,000 remote mountain lakes in California.

Many high mountain lakes with springs or small tributaries can produce large natural crops of eastern brook trout and therefore do not require stocking. In fact, overpopulation and stunting of eastern brooks under such conditions is not uncommon when fishing pressure is light.

California is still a long way from getting the most out of the trout stocked, in terms of recreation and recapture of the stocked fish. More research is the only answer.

Department biologists are exploring the results obtained by stocking different species and strains of fingerlings in various types of lakes. The role of brown trout under California conditions is being investigated because of increased interest in this fish in recent years.

Habitat improvement is another tool of trout management with great possibilities. The removal of rough fish with chemicals can often put a lake with virtually no fishing back into good trout production at a reasonable cost.

Flow maintenance dams, which keep mountain streams running when they would otherwise dry up in late summer, are also good management in California under suitable conditions, although the number of dam sites at which benefits are in line with costs is limited.

Chemical control of weeds that smother some trout lakes, improvement of spawning areas, especially by removal of barriers that block spawning runs, and control of erosion in badly overgrazed meadows all have limited application under California conditions.



*Reyes Creek, Ventura County. The low dam in the foreground is an example of stream improvement work. Trout pools have been formed above the dam and directly beneath the waterfall.*

Small stream improvement devices, which create pools or provide shelter, are not usually needed in California, since most trout streams in their natural state possess a good balance of pools and riffles. Moreover, such devices are subject to destruction by the periodic winter floods that occur in most streams in the State.

Except for rough fish control, the cost of habitat improvement is apt to be high in relation to the benefits. It often costs a good deal more to put another trout into the creel by habitat improvement than by stocking catchable-sized trout.

Under present conditions it is even more urgent to protect the existing trout habitat than to improve it. New power projects are developing throughout the mountain areas. For every such project, it is the responsibility of the Department of Fish and Game to gather and present to the Federal Power Commission or other controlling agencies information demonstrating the need for adequate releases of water for fish.

Small diversions from streams for farming or domestic use can eventually add up to produce a dry stream bed. Improper logging practices are devastating many miles of stream each year. The scene in the illustration is a common one along the north coast.

Ruinous pollution from mining operations is taking place in some areas.

All these developments require strenuous effort just to maintain existing trout habitat. This is a most important management activity, for each loss of habitat reduces the wild trout crop.

*This dam, constructed at the outlet of Upper Emigrant Lake, Tuolumne County, has increased the lake's capacity for trout and helps maintain the flow of water in the stream below.*





*This once fine steelhead spawning stream was loaded with slash from logging operations that rendered useless its spawning gravels.*

The greatest hope for increasing the present supply of trout lies in even more intensive management of existing fisheries. This will involve protection of the existing habitat, carefully controlled stocking of hatchery fish of the best sizes and varieties in each lake and stream, introduction of forage organisms, and habitat improvement when practical. Such management is like intensive farming, wherein every parcel of land is managed to its highest productivity.

Each type of lake and stream presents a different management problem, which can be solved only through research. Unfortunately, fisheries science in this field is many years behind agriculture with its similar problems. Agriculture has developed new and better strains of plants and animals, and has discovered how to get the most from each under different soil and climatic conditions. Fisheries science must do the same.

## COMMON QUESTIONS

### ***What is the difference between a rainbow and a steelhead?***

Although the final word on this subject has not been written, and there may be some disagreement for years to come, it is now generally believed that the most reliable difference between the two fish lies in their migratory habits. In the rainbow the migratory instinct is little developed; it is a fish which tends to stay at home. The steelhead, on the other hand, is a fish which leaves the stream or river in which it was hatched and migrates to the sea, often in its second year of life. In the sea it feeds voraciously and grows rapidly for one or two years, then returns to the stream or river to spawn. In these respects, it is similar to the salmon, but, unlike the salmon, the steelhead does not always die after its first spawning and may come back one or more times to spawn. There are ordinarily some minor differences in structure and coloration between the rainbow and steelhead and usually one can, with experience, see a difference between them when they are found together in a stream.

### ***What is the difference between a brown trout and a Loch Leven?***

As things stand now in California, there are no "Loch Leven" or "German browns"; these names are synonymous with brown trout. The name brown trout or "brownie" is not colorful enough to meet the needs of many anglers and they often prefer to add "German" or to substitute "Loch Leven". No harm is done by using these names, but they are not official in California.

Many years ago, brown trout were imported from Germany and from Loch Leven in Scotland. These two forms differed in coloration and for many years the Department of Fish and Game recognized them as distinct kinds of fish. In time, however, they became mixed, both in the hatcheries and in the wild, and it was impossible to tell which was which. In the 1930's the decision was made to have the official name agree with the official or common name used for these fish in Europe, where they are native.

### ***Why do some trout have a pink meat?***

The color of a trout's flesh is due directly to its food. A hatchery rainbow fed on almost any of the common hatchery diets has white flesh. This is because its food lacks the pigmented oil which produces the pink or salmon color. If this hatchery fish is then liberated in a lake which has an abundance of red copepods, scuds or other freshwater crustaceans, its flesh will in time become quite red, providing, of course, that it eats these foods. Some trout prefer surface insects or other types of lake foods which have little or no pigmented oil and these trout remain white-meated, as they were when released from the hatchery. The eggs of pink-meated trout are a deep salmon color in contrast to the more nearly cream-colored eggs from trout with white meat. The flavor of such pink-meated trout is generally considered better than that of the white-meated individuals.

### ***How many hatchery trout survive to be caught by fishermen?***

There is no short and simple answer to this question. There have been some plants of fingerling trout which apparently yielded nothing to the angler. At the other extreme, we have made a few plants of catchable-sized rainbows in very heavily fished waters and had 98 percent of them caught within a few days.

Usually fingerling trout planted in a lake will yield 5 to 20 percent to the angler during the years following their liberation. These are fish much too small to be caught in the year they are planted and it may be several years before they are caught. During this time a great many things can happen to them. Most of those which are lost are victims of larger cannibalistic trout. The mortality is very heavy while the trout are still in the fingerling stage and gradually becomes less and less as they grow larger. Thus, when a trout of catchable size (7½ inches long or larger) is planted, the loss is relatively low. The Department expects, at the very least, a return to the angler of 50 percent of these fish and it is usually higher. In smaller streams and in lakes from which the planted catchables cannot easily escape, anglers catch about 85 percent.

### ***Why are fingerlings planted in some waters whereas “catchable” trout are planted in others?***

Tests have been conducted in many lakes and streams in California and elsewhere and it has been found that fingerling trout planted in streams and rivers suffer such a very heavy loss that it is uneconomical to maintain good fishing by the use of these small trout. Few of these reach catchable size in one year. Ordinarily, it takes at least two years for such fish to become large enough to catch. The natural mortality is so great that often 98 percent of the hatchery trout released in streams as fingerlings never reach the angler's creel. In contrast to this, a relatively high percentage of the 7½-inch trout are caught. Therefore, even though the cost of raising a catchable-sized fish is many times that of a fingerling, it is necessary to use the large fish when stocking heavily fished streams to assure angler success.

The same is not true of most lakes and reservoirs. If there are not many cannibal trout in such waters, the survival to the creel is high enough to make fingerling stocking economically sound. In most lakes and reservoirs the growth rate of trout is considerably faster than in streams. Fish commonly attain catchable size in one year. Predators are less abundant in lakes and in addition losses due to winter conditions are not as great as in streams. For all these reasons, it is possible to plant fingerlings in lakes and reservoirs and provide good trout fishing for considerably less money than would be the case if catchables had to be used.



## SUGGESTED READING

- Living Fishes of the World.* By Earl S. Herald. Doubleday & Company, Inc., Garden City, N. Y., revised 1962, 304 p.
- The Life Story of the Fish.* By Brian Curtis. Harcourt, Brace and Co., New York, 1949, 284 p. (cloth); Dover Publications, New York, 1961, 284 p. (paperbound).
- The Ways of Fishes.* By Leonard P. Schultz. D. Van Nostrand Co., Inc., New York, 1948, 264 p.
- Fishes.* A guide to familiar American species. A Golden Nature Guide. By Herbert S. Zim and Hurst H. Shoemaker. Simon and Schuster, New York, 1956, 160 p.
- How to Know the Freshwater Fishes.* By Samuel Eddy. Wm. C. Brown Co., Dubuque, Iowa, 1957, 253 p.
- The Fisherman's Encyclopedia.* Edited by Ira N. Gabrielson. Stackpole Co., Harrisburg, Pa., revised 1963, 759 p.
- Freshwater Fishery Biology.* By Karl F. Lagler. Wm. C. Brown Co., Dubuque, Iowa, revised 1956, 421 p.
- Fresh Water Fishing.* Bait and fly casting, spinning, lures and equipment. By Arthur H. Carhart. A. S. Barnes and Co., New York, 1949, 237 p.
- The Western Angler.* An account of Pacific salmon and western trout of British Columbia. By Roderick Haig-Brown. William Morrow & Co., New York, 1947, 356 p.
- Trout.* By Ray Bergman. Knopf, New York, 1952, 482 p.
- Trout Streams.* By Paul R. Needham. Comstock Publishing Co., Ithaca, N. Y., 1938, 233 p.
- Steelhead.* By Claude M. Kreider. G. P. Putnam's Sons, New York, 1948, 182 p.
- Life Histories of the Steelhead Rainbow Trout and Silver Salmon.* By Leo Shapovalov and Alan C. Taft. Calif. Dept. Fish and Game, Fish Bull. no. 98, 1954, 375 p.
- Steelhead to a Fly.* By Clark C. Van Fleet. Little, Brown and Co., Boston, 1954, 275 p.
- All About Brook Trout from Maine to California.* With pointers on where and how to fish for them. By Bob Elliot. Practical Science Publishing Co., Inc., Orange, Conn., 1954, 242 p.
- Waters of the Golden Trout Country.* By Charles McDermant. G. P. Putnam's Sons, New York, 1946, 162 p.
- Yosemite and Kings Canyon Trout.* By Charles McDermant. G. P. Putnam's Sons, New York, 1947, 178 p.
- Fishes of Yosemite National Park.* By Willis A. Evans and Orthello L. Wallis. Yosemite Nature Notes, revised 1955, 30 p.
- Inland Fisheries Management.* Edited by Alex Calhoun. California Department of Fish and Game, 1966, 546 p.

- Fish and Fishing in Lassen Volcanic National Park.* By Merlin K. Potts and P. E. Schulz. Loomis Museum Association, Mineral, Calif., 1953, 61 p.
- California "Catchable" Trout Fisheries.* By Robert L. Butler and David P. Borgeson. Calif. Dept. Fish and Game, Fish Bull. no. 127, 1965, 47 p.
- A Revised Check List of the Freshwater and Anadromous Fishes of California.* By Leo Shapovalov, William A. Dill, and Almo J. Cordone. Calif. Fish and Game, 1949, vol. 45, no. 3, p. 159-180.
- Keys to the Freshwater and Anadromous Fishes of California.* By J. B. Kimsey and Leonard O. Fisk. Calif. Fish and Game, 1960, vol. 46, no. 4, p. 453-479.
- Distinctive Characters of the Species of Anadromous Trout and Salmon Found in California.* By Leo Shapovalov. Calif. Fish and Game, 1947, vol. 33, no. 3, p. 185-190.
- Trout and Salmon Culture (Hatchery Methods).* By Earl Leitritz. Calif. Dept. Fish and Game, Fish Bull, no. 107, reprinted 1969, 169 p.
- Aquatic Insects of California.* With keys to North American genera and California species. Edited by Robert L. Usinger. Univ. of California Press, 1965, 508 p.
- McClane's Standard Fishing Encyclopedia and International Angling Guide.* Edited by A. J. McClane. Holt, Rinehart and Winston, Inc., New York, 1965, 1057 p.

## ACKNOWLEDGMENTS

This booklet in its present form is based upon earlier editions prepared by J. H. Wales, formerly of the California Department of Fish and Game.

The 12 black and white drawings of trout were made by Felicien Philippe of Hollywood. The cover illustration and the drawings of the kokanee salmon and mountain whitefish were done by Paul Johnson of Sacramento.

The illustrations of trout food insects were made by Dr. E. Laurence Palmer and are used through the courtesy of *Nature Magazine*.

---

"In writing on the trout of California, one does not willingly lay down the pen at the end. The most beautiful of fishes, the most charming of lands, where the two are connected, one wishes to say something better of them than has been said. It is with regret that he lets fall the pen in confession of inability to say it."

DAVID STARR JORDAN

From SALMON AND TROUT OF THE PACIFIC COAST

*Thirteenth Biennial Report of the State Board of Fish Commissioners  
of the State of California, 1893-94*

## GLOSSARY

- Adipose fin*—the small, fleshy fin on the back between the dorsal and tail fins.
- Anadromous*—ascending streams from the ocean for spawning.
- Anal fin*—the fin on the under side of the fish between the vent and the tail.
- Anterior*—in front of, or toward the head end.
- Caudal fin*—the tail fin.
- Caudal peduncle*—the slender portion of the body just ahead of the tail fin.
- Dorsal fin*—the large fin on the back.
- Fingerling*—The Trout Policy of the California Department of Fish and Game designates all trout weighing one ounce or less as fingerlings; a one-ounce rainbow trout is about 5 inches long.
- Fry*—the young of fishes.
- Gill arch*—the bony arch to which the gill filaments and gill rakers are attached.
- Gonad*—an ovary or testis.
- Lateral line*—a series of sensory pores and tubes that appear as a line along the side of the fish.
- Mandible*—the lower jaw.
- Maxillary*—the hindmost bone of the upper jaw.
- Milt*—male sex product.
- Opercle*—the gill cover.
- Ovaries*—the female reproductive organs which produce the eggs.
- Parr marks*—the dark vertical bars lying in a row along the sides of young trout and occasionally of older trout (see illustrations of golden trout).
- Pectoral fins*—the paired fins attached just behind the head.
- Ray*—a supporting element in any of the fins (none in the adipose fin). In trout the rays are segmented and flexible.
- Spawning*—the act of laying and fertilizing eggs.
- Testes*—the male reproductive organs which produce sperm.
- Ventral fins* (pelvic fins) —the paired fins attached to the belly directly beneath the dorsal fin.
- Vomer*—the bone in the roof of the mouth toward the front.
- Yolk sac*—a sac containing yolk, attached to the belly of recently hatched trout. The yolk is used as food and is finally absorbed.



STATE OF CALIFORNIA  
RESOURCES AGENCY  
DEPARTMENT OF FISH AND GAME  
1416 9th Street  
Sacramento, California 95814

Return Postage Guaranteed



**PREVENT  
FOREST FIRES!**